Human Health Risk Assessment Tools: Supporting the Risk Assessment Process at the National Homeland Security Research Center

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Abstract

EPA's National Homeland Security Research Center (NHSRC), Threat and Consequence Assessment Division (TCAD), evaluates the human health risks associated with the release of contaminants into the environment. To support this evaluation, TCAD develops risk assessment methods and tools and risk communication techniques that will be of practical assistance to government agencies and first responders dealing with threats from chemical, biological, and radiological contamination. Two tools being developed to assist EPA first responders, risk assessors, and decision-makers are the Data Dictionary (DD) and the Emergency Consequence Assessment Tool (ECAT).

The DD includes a compilation of primary and secondary data on toxicity, infectivity, dose-response, and health effects for NHSRC's priority list of chemical, biological, and radiological agents.

The ECAT is an interactive web-based software tool designed to provide a wide range of emergency response officials with accurate information in a rapid manner during a major environmental crisis caused by a terrorist attack or natural disaster. ECAT has been designed to include many critical features that will assist the needs of a wide range of emergency response officials including first responders, health advisors, and senior decision-makers.

Both these tools will undergo rigorous internal and external peer review to ensure scientific credibility and technical quality. In combination, these tools offer a powerful means to quickly and efficiently gather pertinent information on the health risks posed by agents that are of primary concern to the Nation's security. These tools will play an important role in understanding human health risks and will provide the means for risk assessors and managers within and outside the Agency to make informed decisions that can be utilized to conduct innovative human health risk assessments.

Data Dictionary

Overall Purpose

To develop a compendium of toxicity data to support NHSRC's five primary research and development activities:

- TCAD (e.g., rapid risk assessment tools)*
- Decontamination (e.g., BDR)
- Water protection
- Response capability
- Technology testing
- EPA Program Offices

Project Tasks

- Compile and summarize toxicity data (acute, subchronic, chronic, duration exposure) for 96 agents
- Compilation of benchmarks (LOAEL, NOAEL, LD_{50}) from international literature in addition to national literature
- Compilation of chemical specific projects within and outside the Agency

What types of information are being compiled?

- Toxicity, critical effect and benchmark data from both secondary and primary literature
- Chemical properties data from secondary literature only, fate and transport data, if available, from secondary literature only
- Toxicity, critical effect and benchmark data from international literature

Study Design

Step 1: Design the project database and develop a data dictionary

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Step 2: Identify benchmark values developed by authoritative scientific bodies (phased approach)

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Step 3: Conduct literature searches of the primary literature (phased approach) and build a comprehensive endnote library

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Step 4: Prepare interim and final draft

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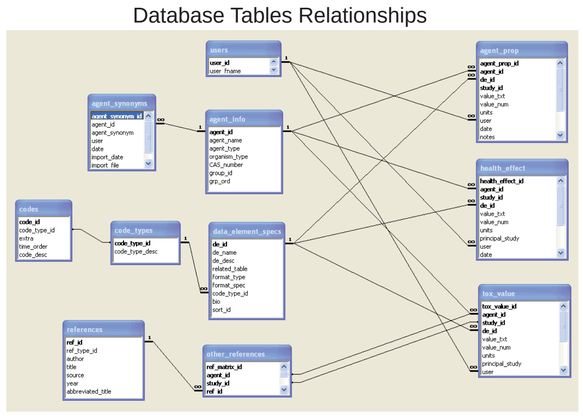
Step 5: External review/buy-in of the database

Database Design

Basic Features

- MS Access 2000+
- Series of core and supporting tables
- Designed and developed to facilitate the entry, QA/QC review, and retrieval of data for 96 threat agents

Database Tables Relationships



Core Tables

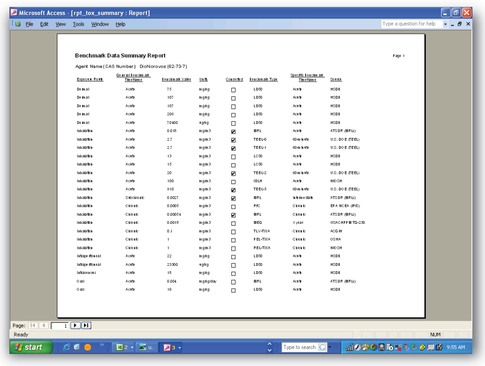
- Agent properties
- Agent synonyms
- Established benchmarks/ toxicity values
- Dose-response data from primary literature (not yet populated)

Database Reports

"Select a Report"

- Agent properties report (consolidates agent-specific data into a single report) Synonym report
- Benchmark data summary report (at a glance values across data sources)
- Benchmark data detailed report (presents individual benchmark data along with available supporting data)
- Future feature: Dose-response data from primary literature
- ReadMe file - provides guidance for the use of the database

Sample Screen Shot



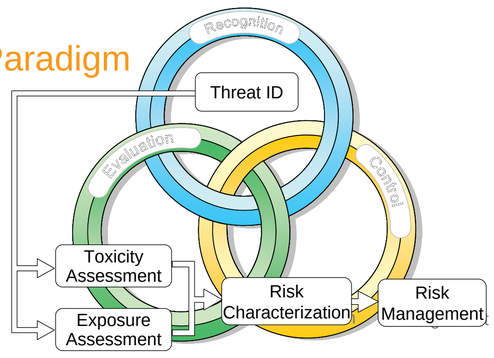
Reporting Options

- Select a single agent or all agents (sort by agent name or CASRN)
- Displays summary tables or allows for export to Excel (user option)
- Future feature: Links to benchmark-specific "critical study(ies)" in electronic format-controlled access due to copyright issues

Emergency Consequence Assessment Tool (ECAT) Background

- ECAT combines the decision making processes of the emergency response paradigm and the risk assessment paradigm into a tool that provides rapid communication and informed risk management of chemical and biological agents.

ECAT Paradigm



ECAT Overall Purpose

- Develop a library of key risk assessments, consequence management information and an interactive calculator for site-specific applications.

Stakeholders/Users

- Emergency planners and trainers
- Emergency responders
- Health advisors
- Risk assessors
- On-scene coordinators

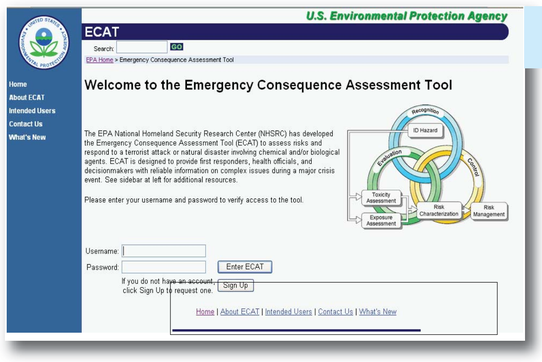
What does ECAT provide?

- Provides the ability to model the effects of a contaminant release into either water or air, indoors or outdoors.
- Provides step-by-step guidance for quantifying and managing risks from specific chemical and biological agents, pathogens and diseases.
- Provides integration of a wide variety of data for rapid determination of scenario-specific contamination

ECAT Products

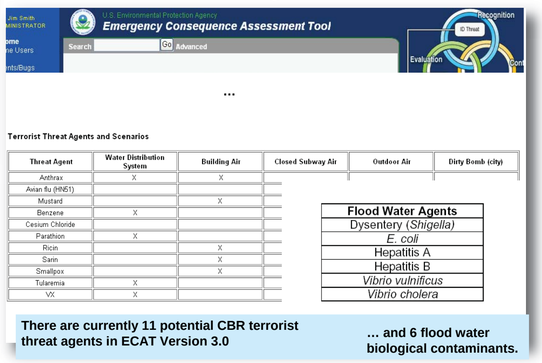
- Contaminant-specific characteristics, exposure routes, and symptoms of exposure
- Contaminant-specific recommendations for sampling methodologies, protective equipment, decontamination, and disposal options
- Information on risk characterization, evacuation planning, and preventive measures for each contaminant
- Health data for a variety of contaminants, including toxicological properties and critical symptoms
- Hyperlinks to other EPA databases and models
- One-page fact sheets and templates suitable for communicating risk-related conclusions to the public

Sample Slides: ECAT Welcome Screen



This is the welcome screen for ECAT. Usernames and passwords are required to ensure secure access by EPA personnel only.

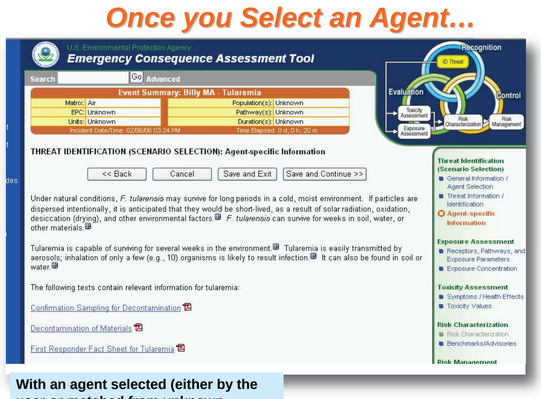
ECAT Agents



There are currently 11 potential CBR terrorist threat agents in ECAT Version 3.0

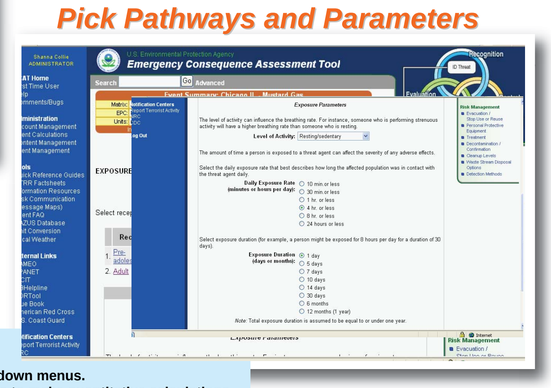
… and 6 flood water biological contaminants.

Once you Select an Agent…



With an agent selected (either by the user or matched from unknown symptoms and physical properties), all areas of the ECAT paradigm (upper right graphic) and agent-specific links are now active and available using the right navigation bar.

Pick Pathways and Parameters



The Exposure Assessment includes defining the types of exposed people (adults, children, etc.) and the nature of their exposure is described with user inputs using buttons and drop-down menus. Those user inputs are linked to EPA default exposure parameters to make quantitative calculations.

Conclusions for DD

Comprehensive database provides information on benchmark values, exposure durations, and critical effects from both secondary and primary literature for a large group of chemcials.

Conclusions for ECAT

This risk tool provides rapid access to key information during environmental emergencies and will facilitate critical data analyses.

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